Phoenix AMA Groundwater Model

June 2, 2023

If you are on the webinar, please have microphones on mute.

At the end of the meeting, we will take questions.

If you are online, please submit a question via the online comment form available in the chat.

Phoenix AMA Groundwater Model

Calibration and 100-year AWS Projection

Arizona Department of Water Resources

June 2, 2023

Agenda

- AWS Program Overview
- Development of the Phoenix AMA Groundwater Model
- Description & Results of the 100-year AWS Projection
- Key Takeaways

Assured Water Supply (AWS) Program Overview

- Adequacy program created statewide in 1973 to provide consumer protection
- Evaluates the availability of a 100-year water supply considering existing, approved and project demands
- AWS program developed in 1980 to add groundwater management components to adequacy program
- Operates in Arizona's Active Management Areas (AMAs)

AWS Program Implementation

- Within AMAs, a developer of a proposed subdivision must have a 100-year Assured Water Supply to obtain plat approval and offer lots for sale
- Two ways for a developer to demonstrate an AWS:
  - Obtain a commitment of water service from a water provider that has been designated by ADWR as having an AWS
  - Obtain a Certificate of AWS from ADWR by demonstrating that the subdivision will have a 100-year AWS

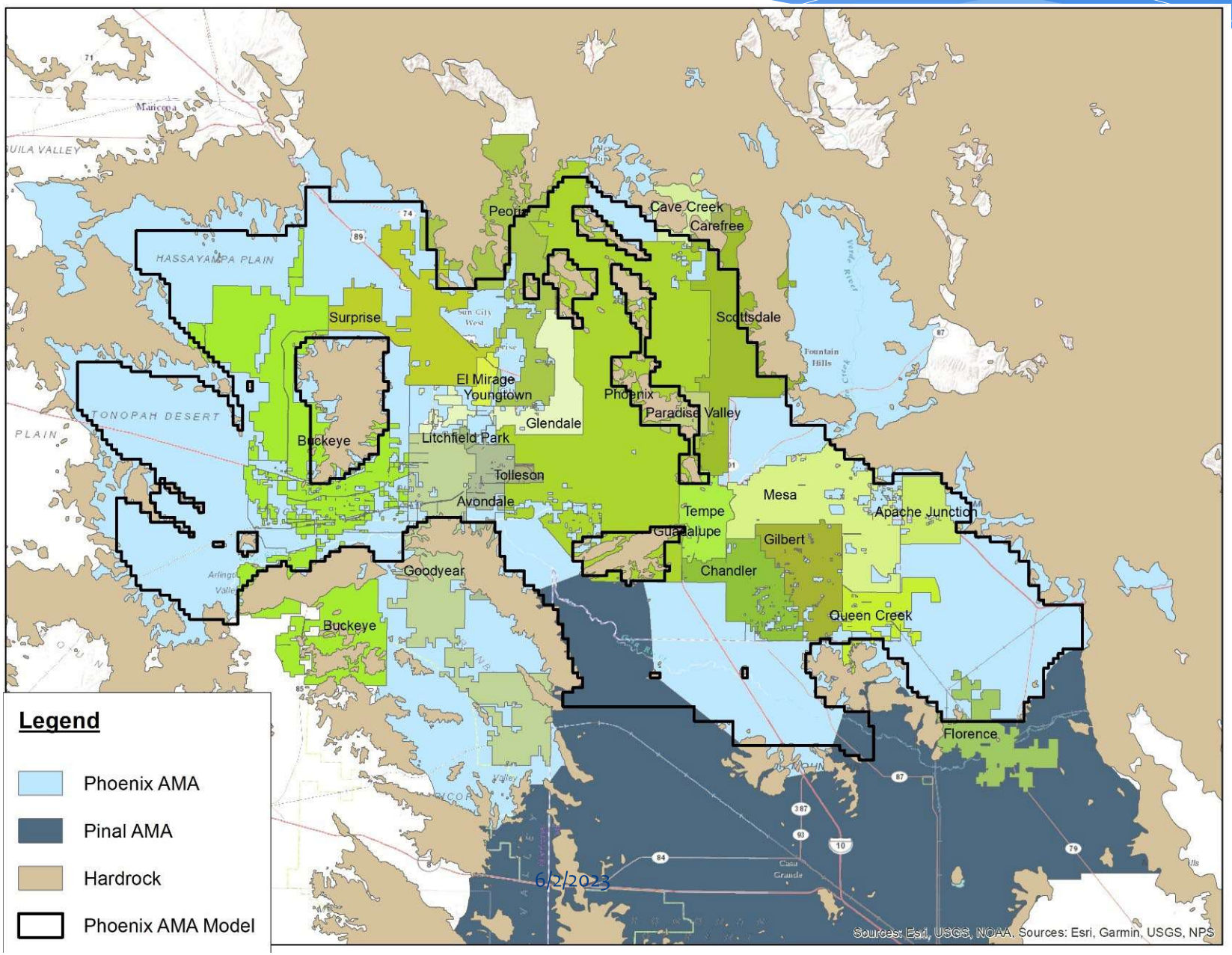
AWS Criteria

- Physical, continuous, and legal availability for 100 years
- Other requirements related to financial capability, water quality, and consistency with Management Plan/Goal
- Physical availability of groundwater is demonstrated with a model

History of Model Development

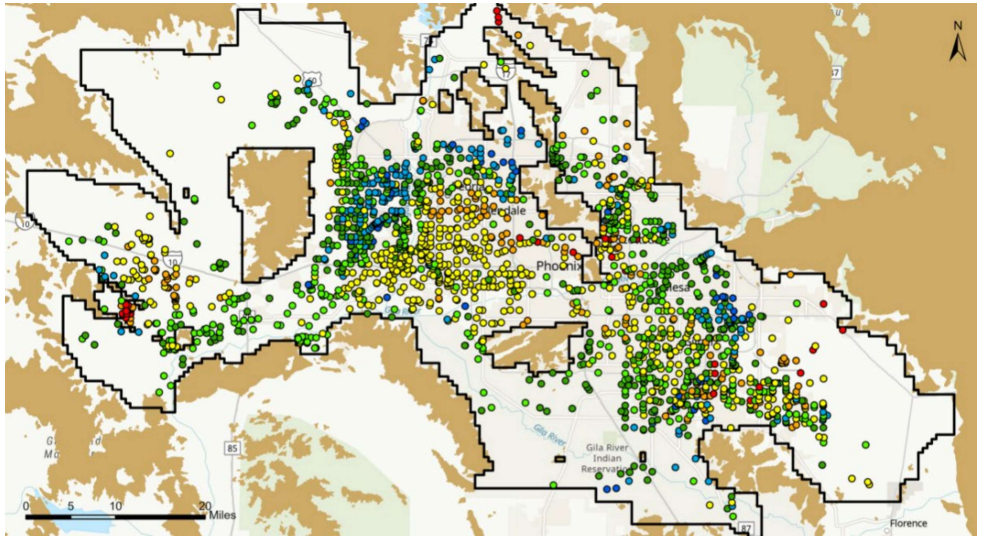
- 1990s ADWR created a MODFLOW model of the Salt River Valley (ESRV and WSRV)
- Most recently updated in 2009
- Brown and Caldwell 2006 Lower Hassayampa model
- ADWR updated/recalibrated the 2023 Lower Hassayampa model and 100-year AWS projection
- 2023 release of Phoenix AMA model, which combines the SRV with the Lower Hassayampa

Phoenix AMA Model Development



Phoenix AMA Model Calibration

- Calibration period of pre-1900 to 2021 (122 years)
- Multiple types of calibration targets
  - 40,577 WLEs from wells
  - 325 aquifer tests
  - Streamflow from 5 gaging stations
  - Baseflow from historical observations
- Peer-reviewed
- Industry standard robust calibration
- Consistent with conceptual model
- Best-available science for use with the AWS program



Distribution of Head Residuals in Layer 2

Average Head Residual (Layer 2) (feet)

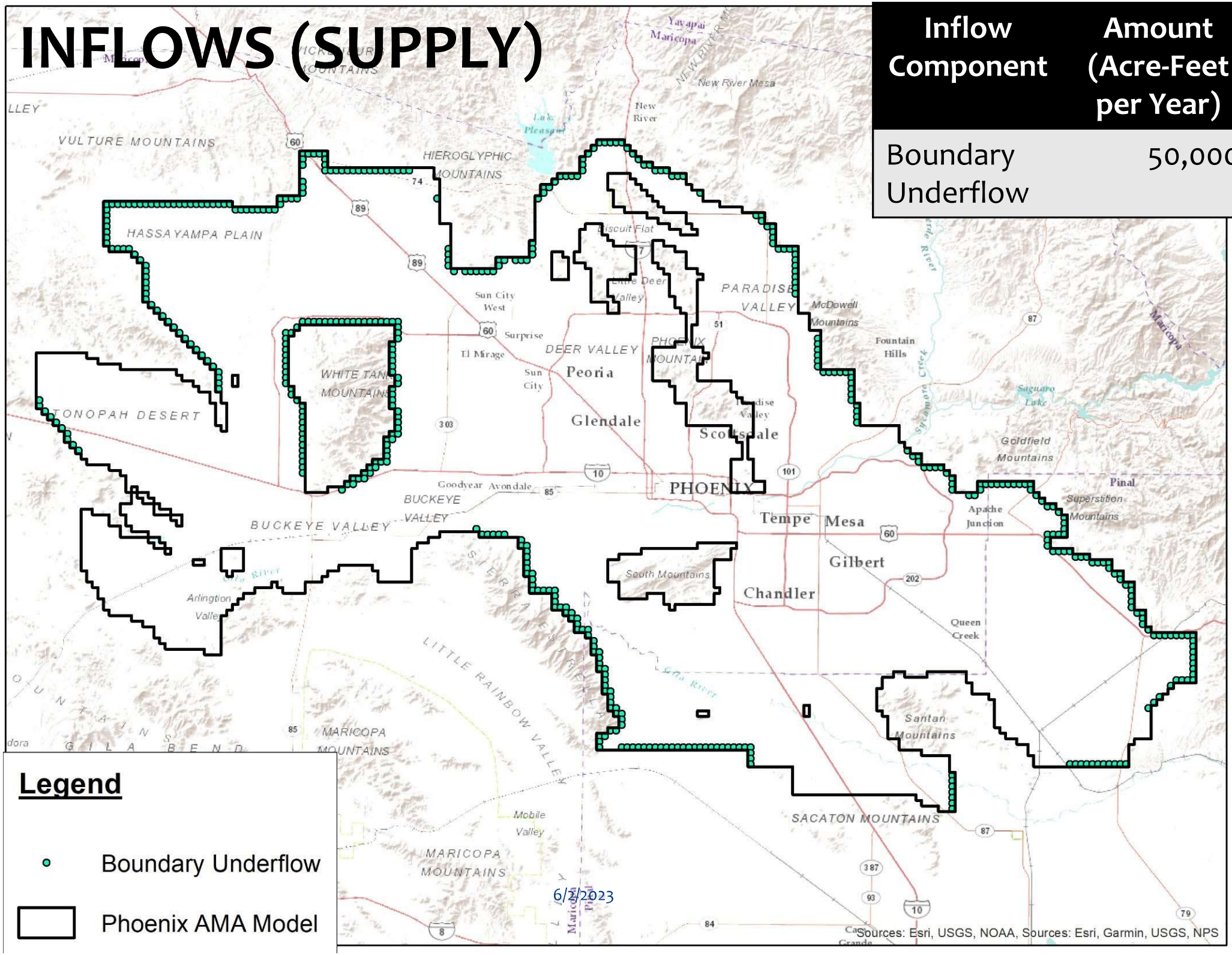
- -148 to -100
- -100 to -50
- -50 to -10
- -10 to 10
- 10 to 50
- 50 to 100
- 100 to 230
- Active Model Domain
- Bedrock

Using the Model for Projection Purposes

- Distinction between the calibrated model and the 100-year projection
- "Build the tool; use the tool"
- Run the model with the AWS program requirements for supply and demand based on:
  - Historical recharge rates (calibrated model)
  - Existing demands (reported pumping)
  - Issued demand (AWS program)

INFLOWS (SUPPLY)

Inflow Component	Amount (Acre-Feet per Year)
Boundary Underflow	50,000

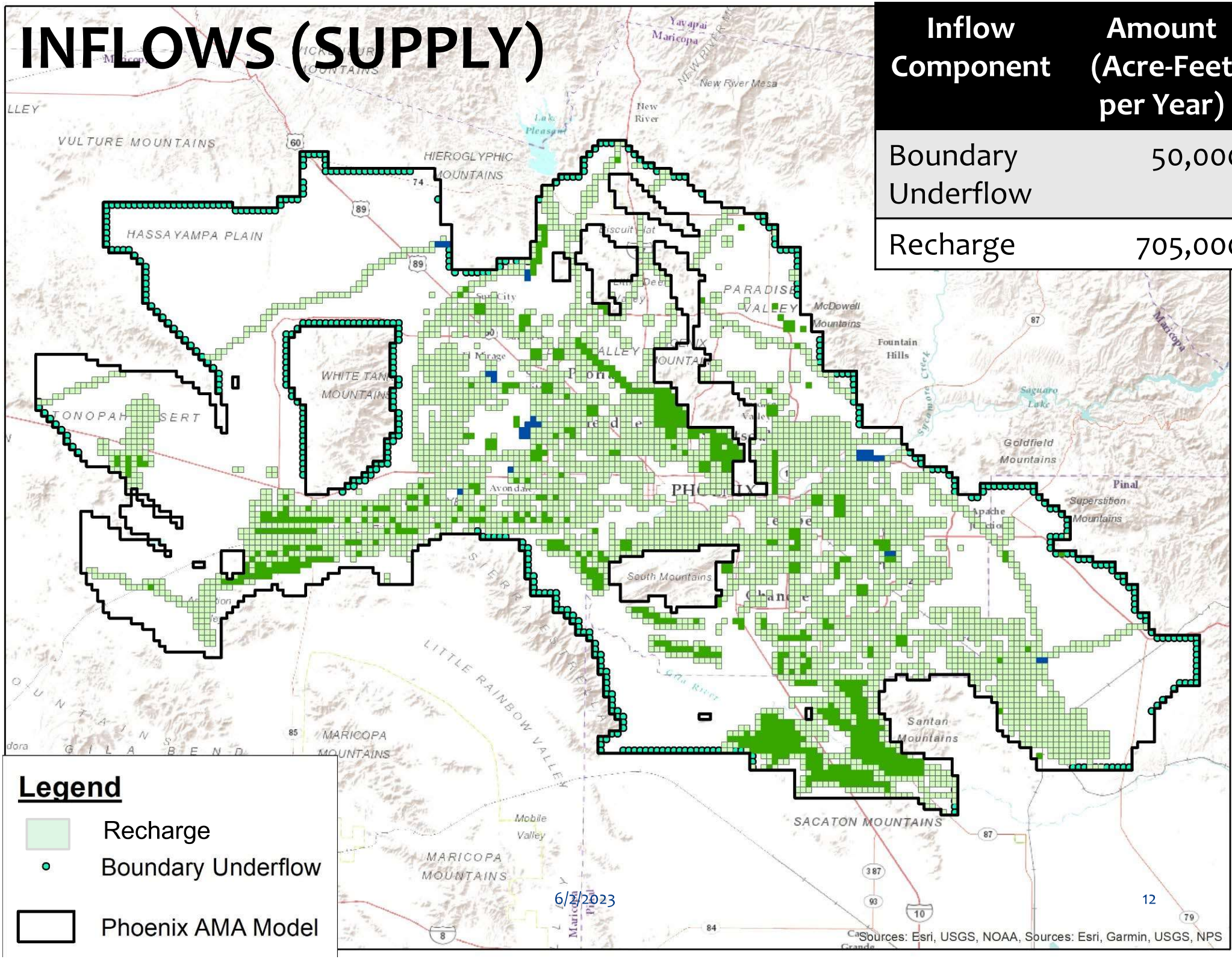


Legend

- Boundary Underflow
- Phoenix AMA Model

INFLOWS (SUPPLY)

Inflow Component	Amount (Acre-Feet per Year)
Boundary Underflow	50,000
Recharge	705,000

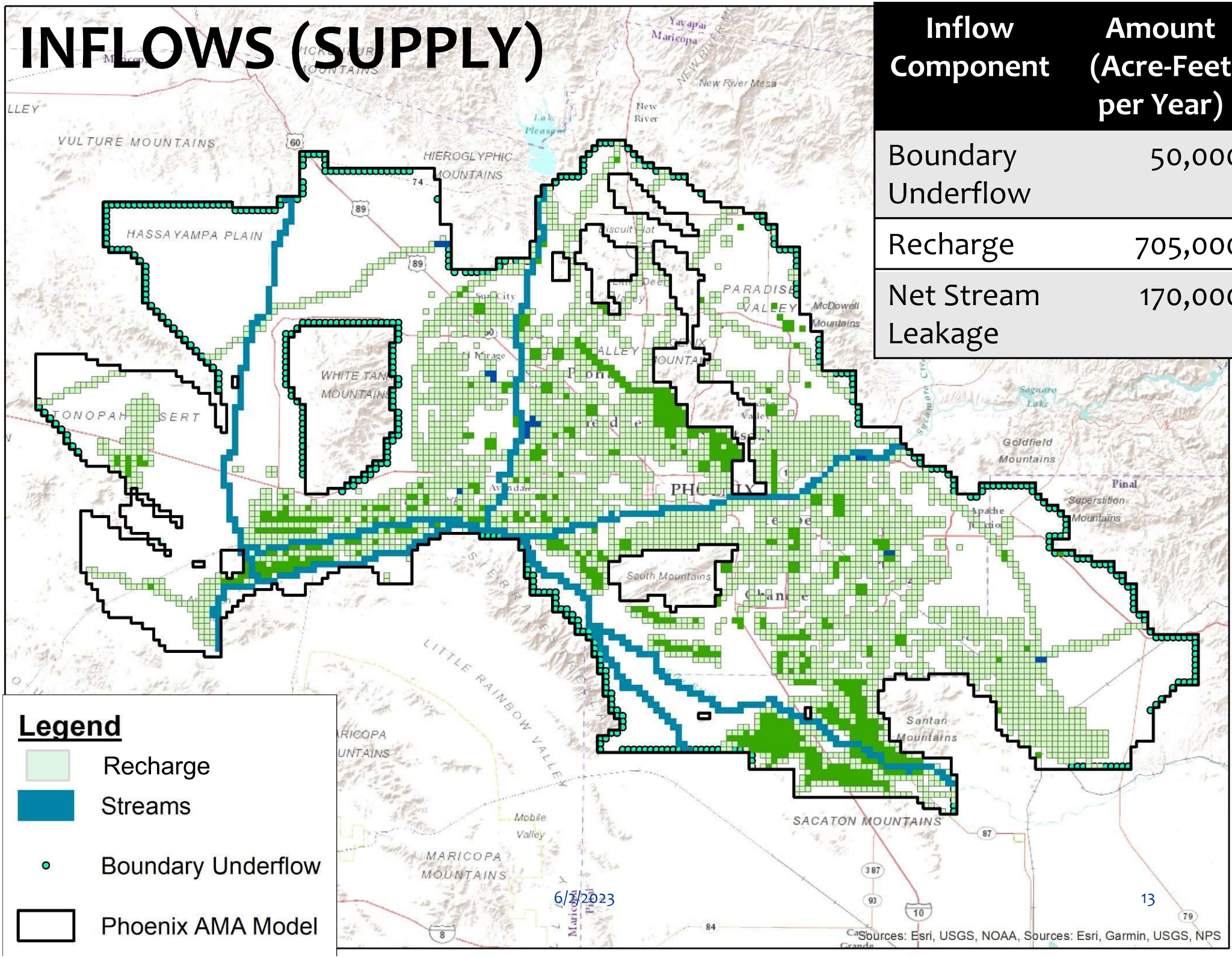


Legend

- Recharge
- Boundary Underflow
- Phoenix AMA Model

INFLOWS (SUPPLY)

Inflow Component	Amount (Acre-Feet per Year)
Boundary Underflow	50,000
Recharge	705,000
Net Stream Leakage	170,000

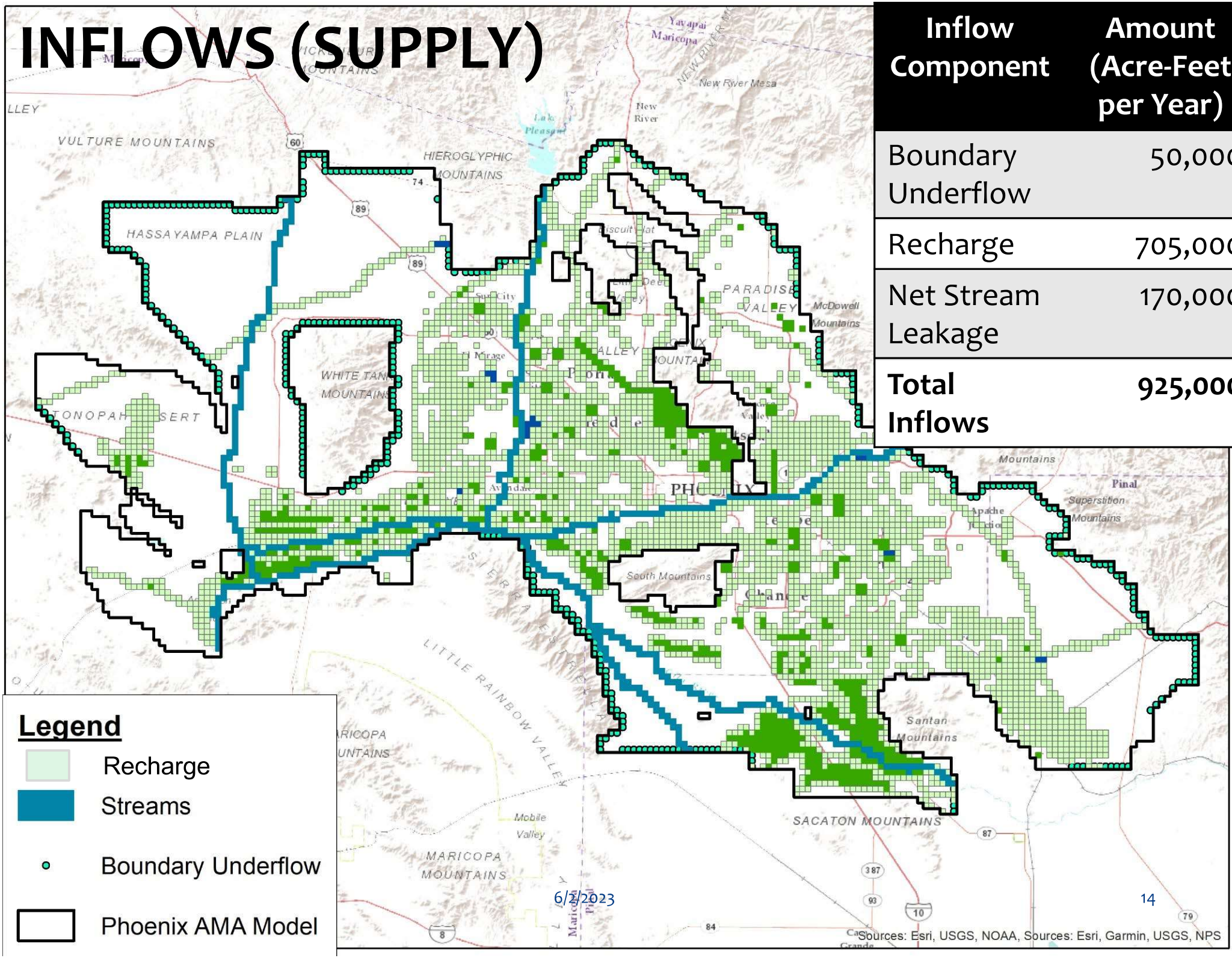


Legend

- Recharge
- Streams
- Boundary Underflow
- Phoenix AMA Model

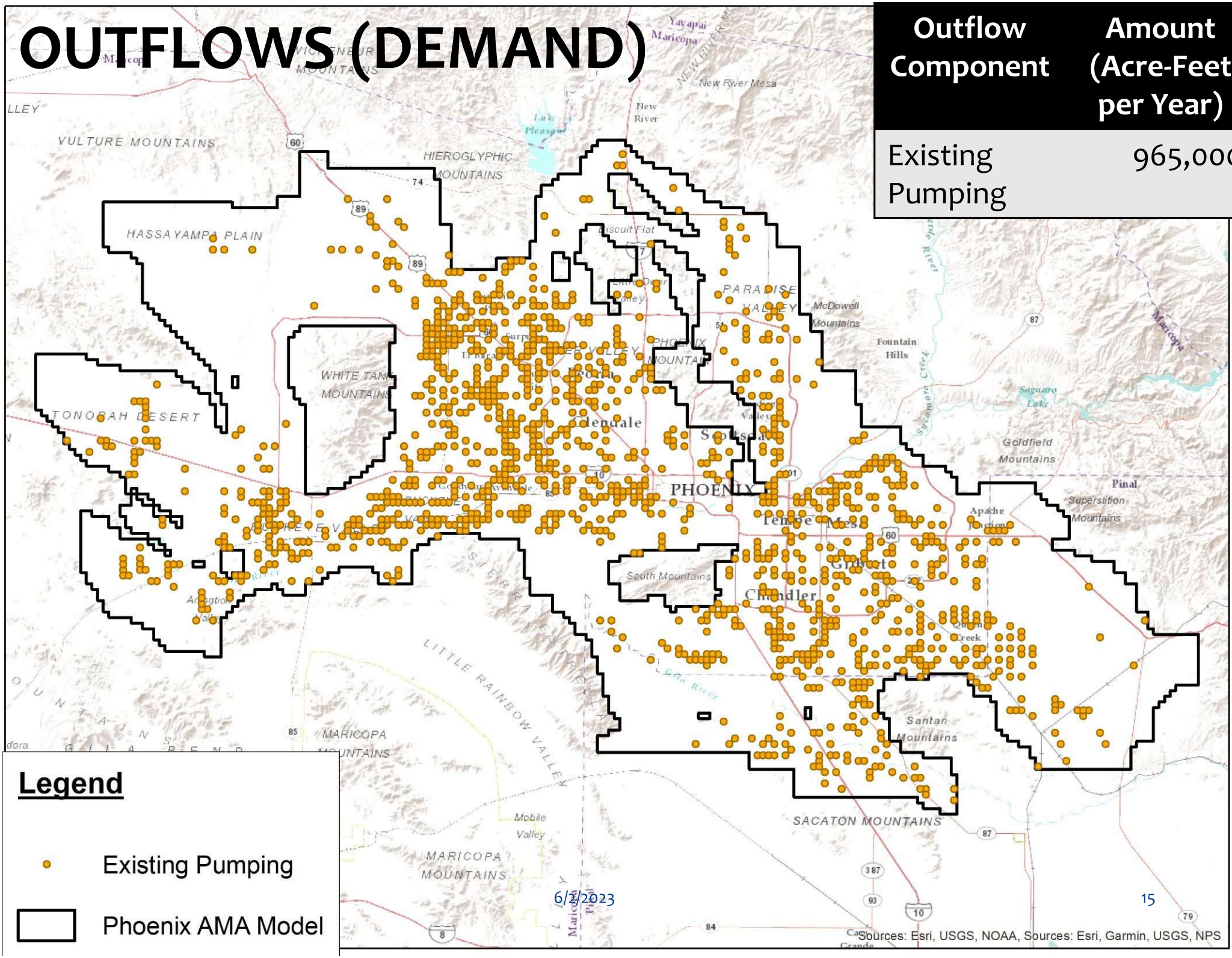
INFLOWS (SUPPLY)

Inflow Component	Amount (Acre-Feet per Year)
Boundary Underflow	50,000
Recharge	705,000
Net Stream Leakage	170,000
Total Inflows	**925,000**



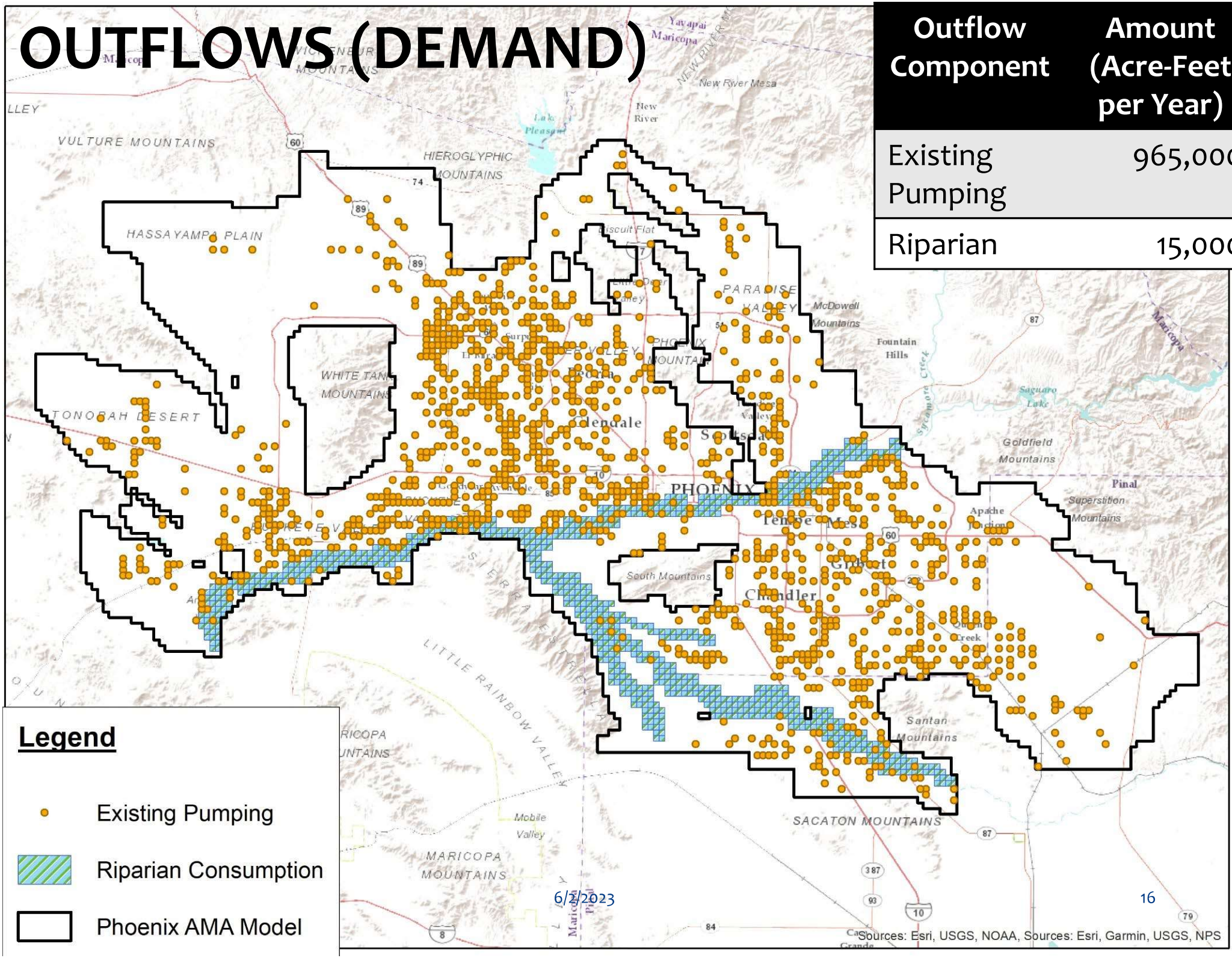
OUTFLOWS (DEMAND)

Outflow Component	Amount (Acre-Feet per Year)
Existing Pumping	965,000



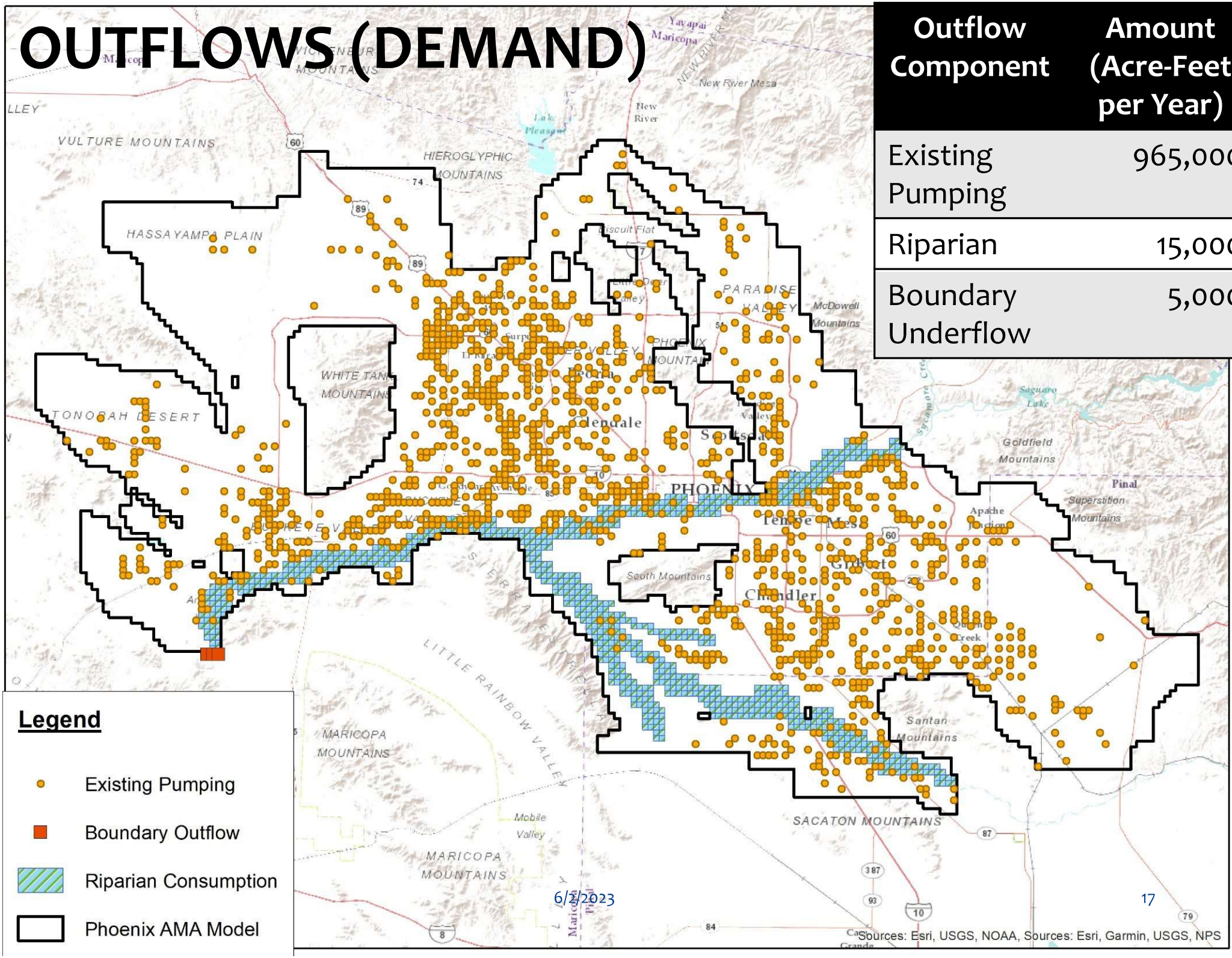
OUTFLOWS (DEMAND)

Outflow Component	Amount (Acre-Feet per Year)
Existing Pumping	965,000
Riparian	15,000



OUTFLOWS (DEMAND)

Outflow Component	Amount (Acre-Feet per Year)
Existing Pumping	965,000
Riparian	15,000
Boundary Underflow	5,000

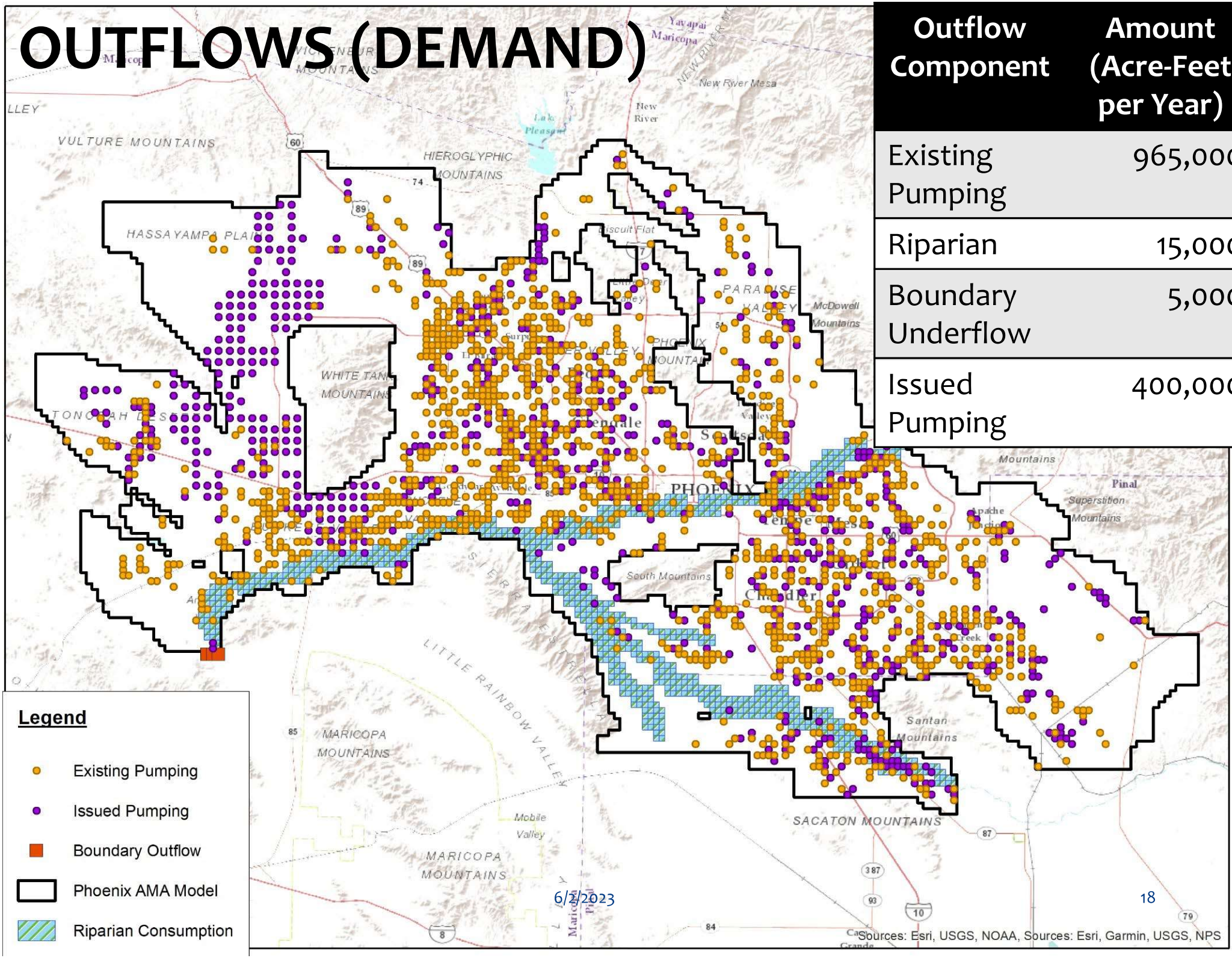


Legend

- Existing Pumping
- Boundary Outflow
- Riparian Consumption
- Phoenix AMA Model

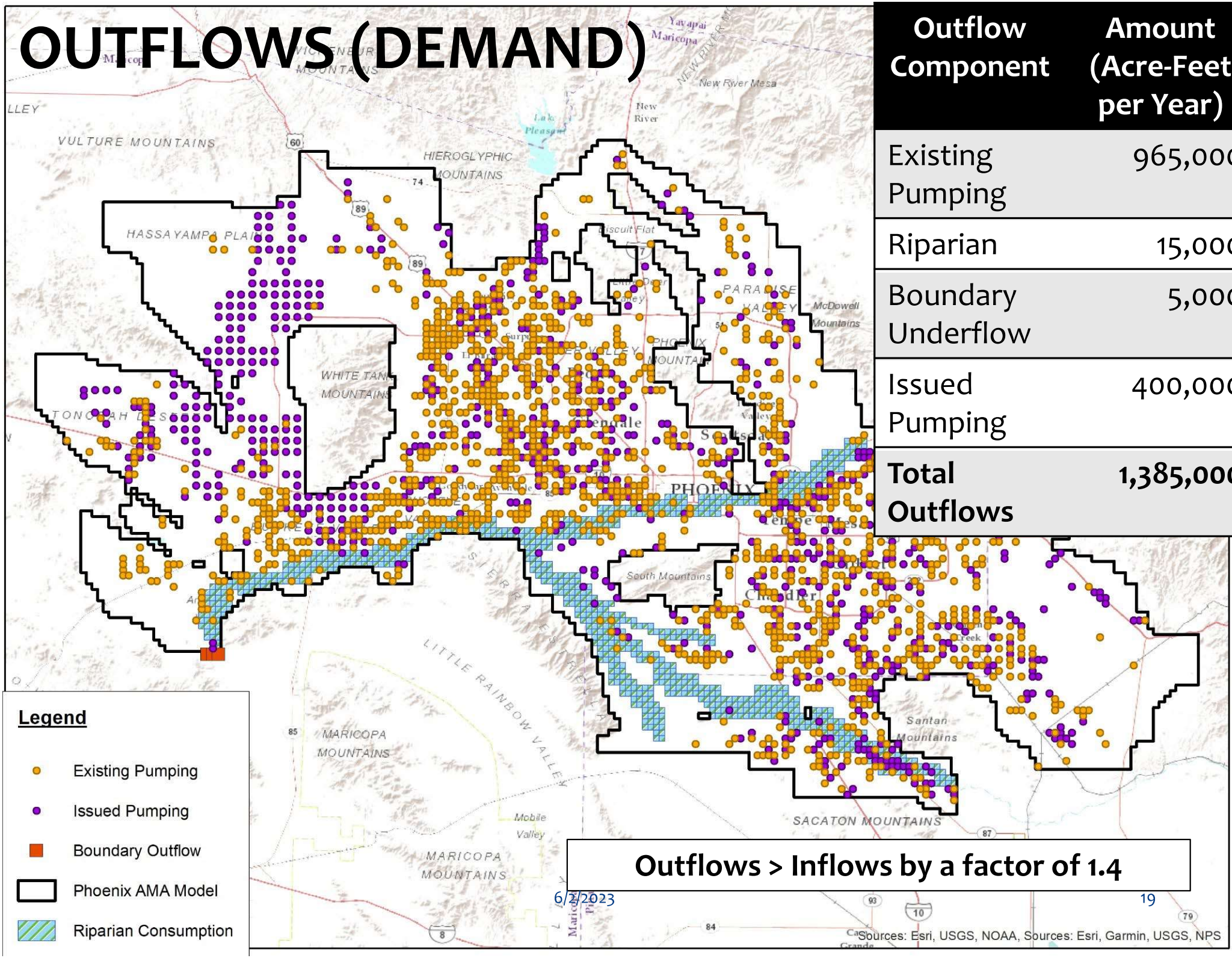
OUTFLOWS (DEMAND)

Outflow Component	Amount (Acre-Feet per Year)
Existing Pumping	965,000
Riparian	15,000
Boundary Underflow	5,000
Issued Pumping	400,000



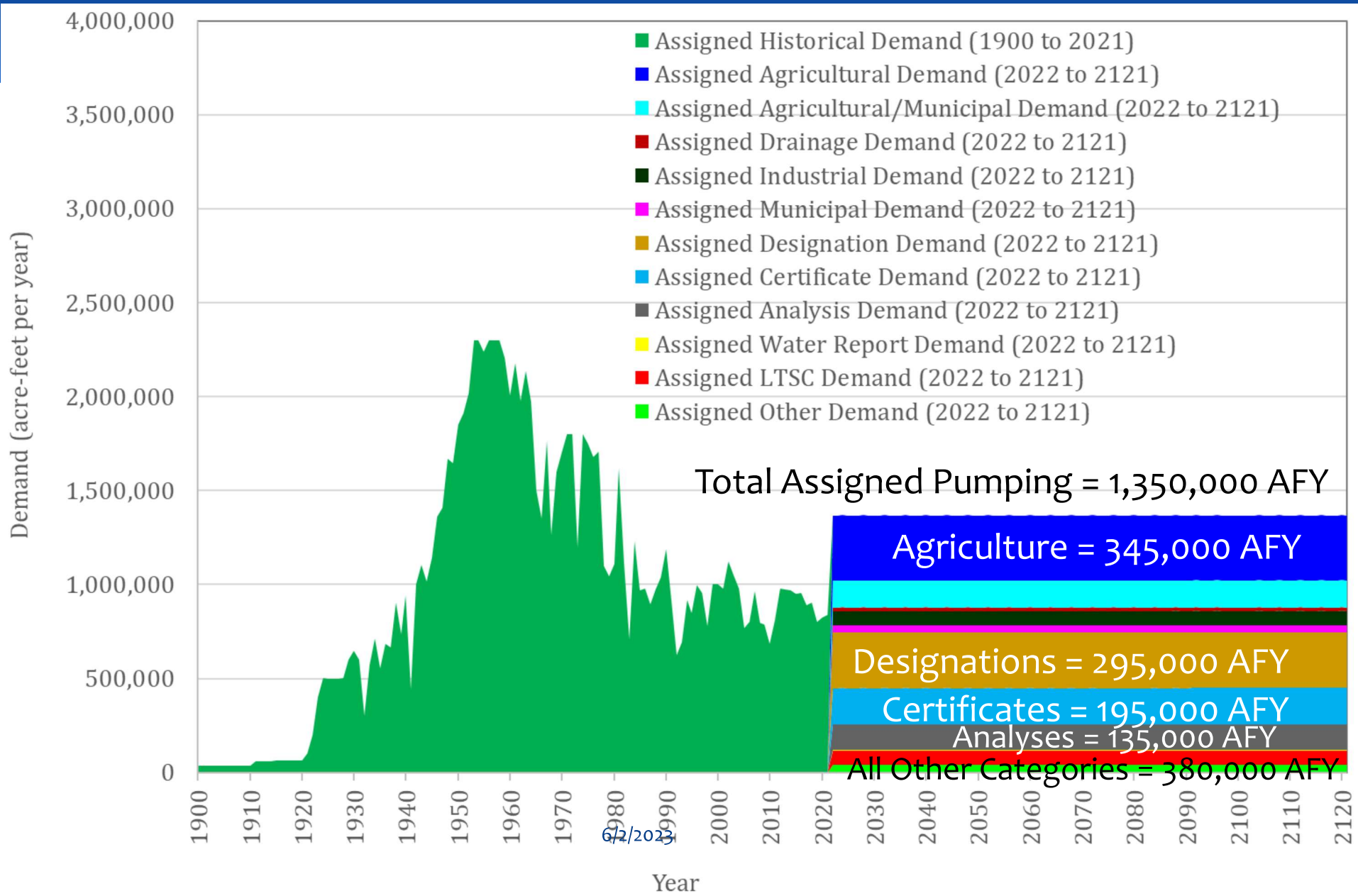
OUTFLOWS (DEMAND)

Outflow Component	Amount (Acre-Feet per Year)
Existing Pumping	965,000
Riparian	15,000
Boundary Underflow	5,000
Issued Pumping	400,000
Total Outflows	**1,385,000**

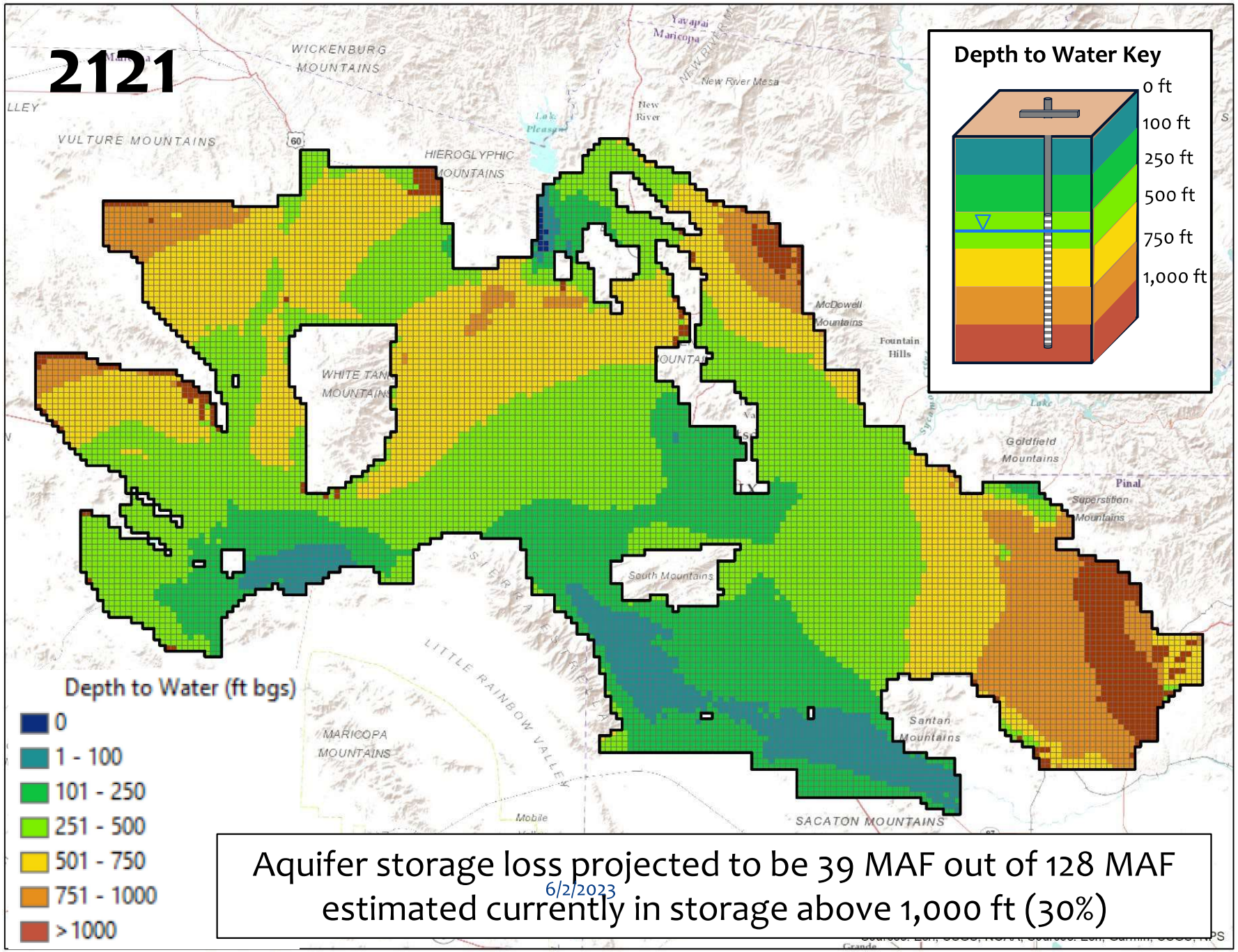


Outflows > Inflows by a factor of 1.4

Assigned Pumping in Projection

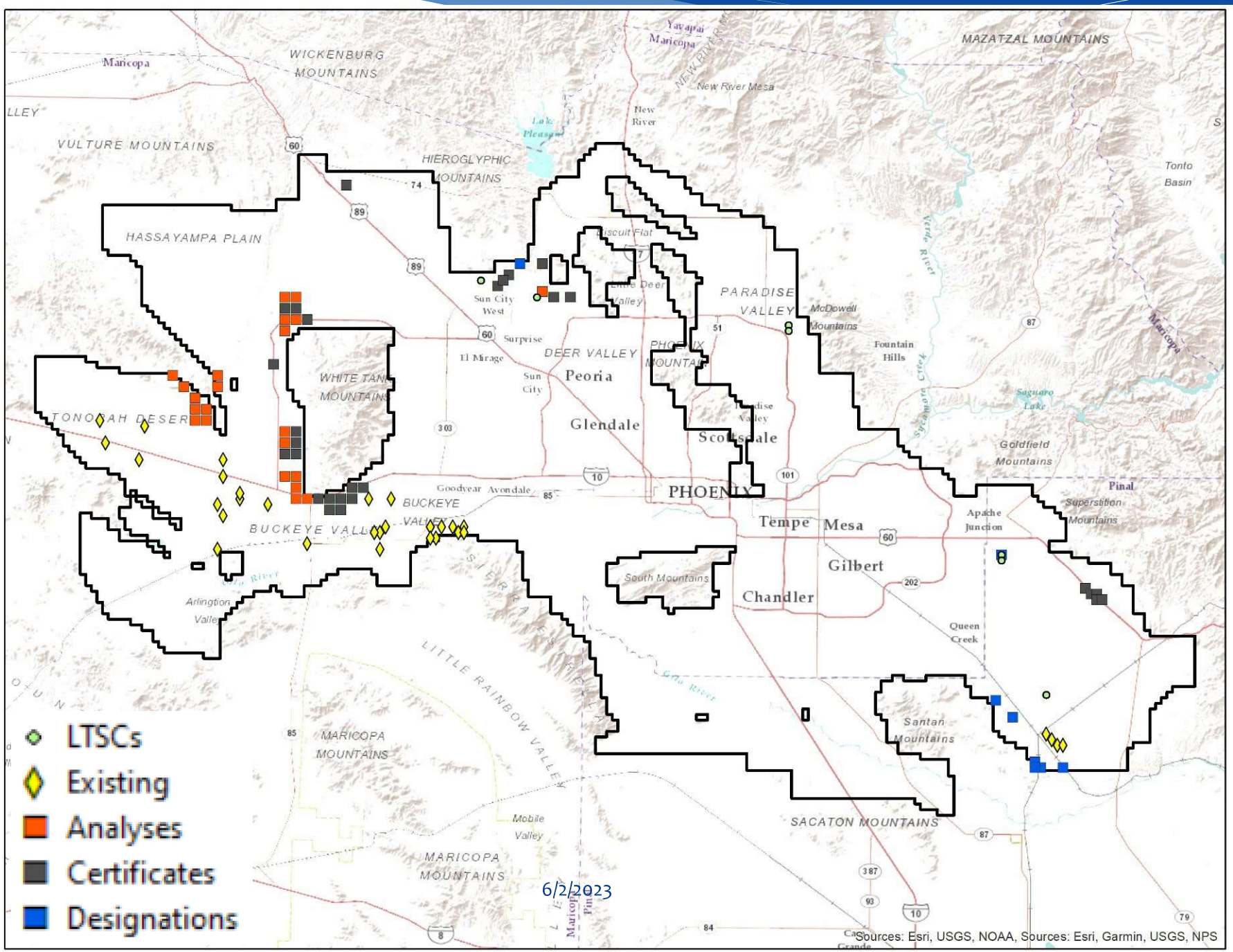


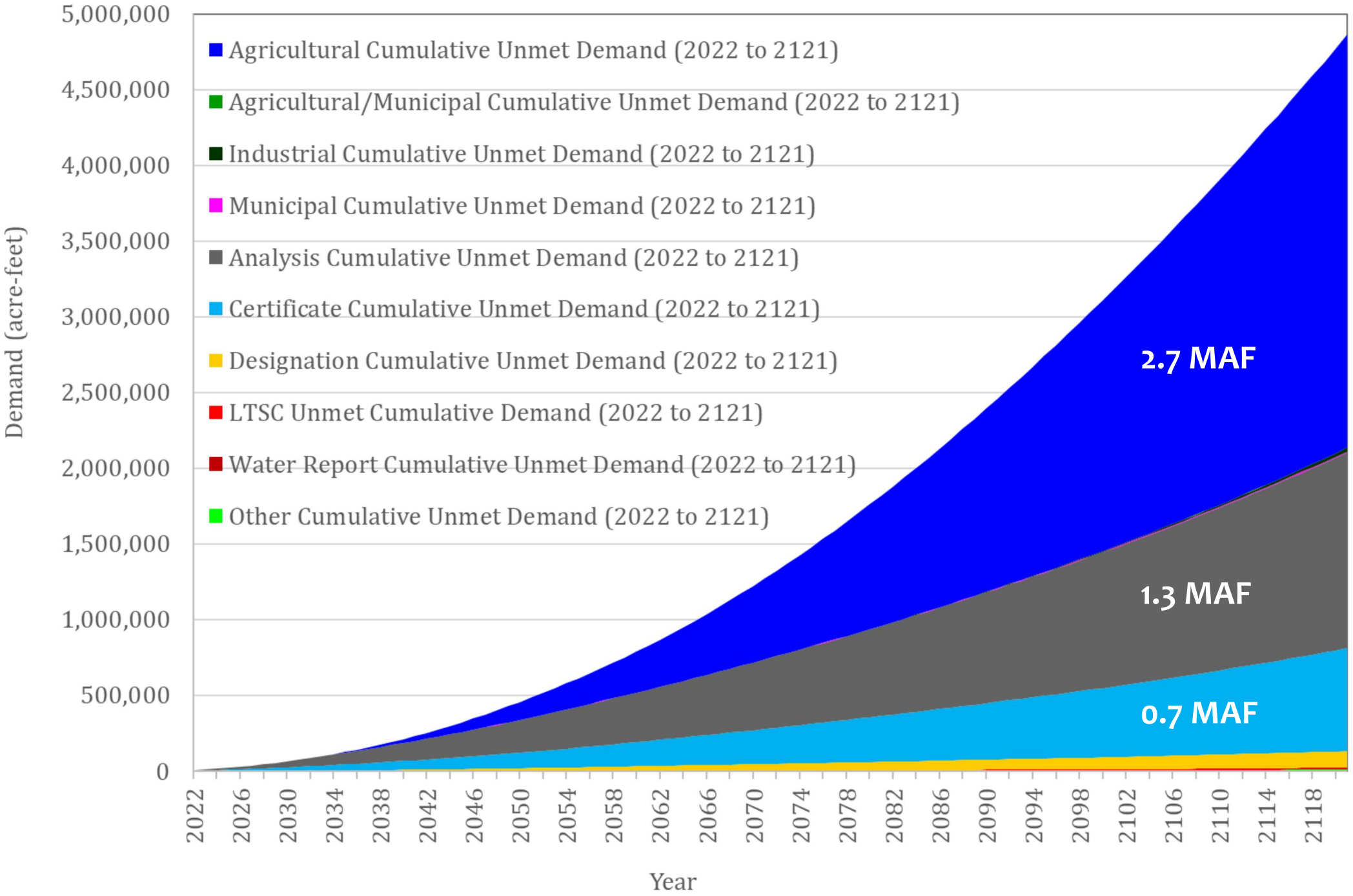
Simulated Depth to Water after 100 Years



Aquifer storage loss projected to be 39 MAF out of 128 MAF estimated currently in storage above 1,000 ft (30%)

Unmet Demand



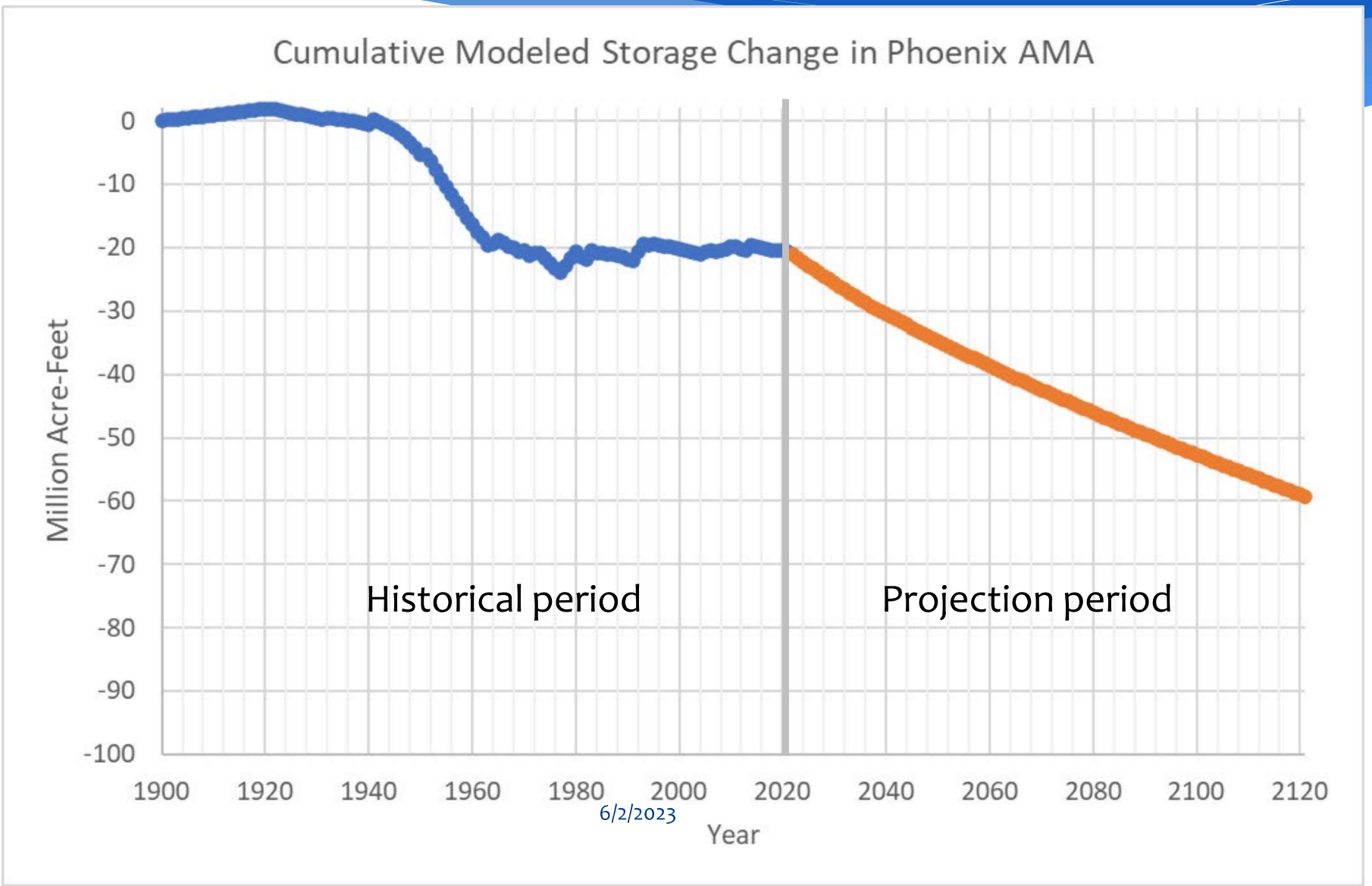

5,000,000
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Demand (acre-feet)
Agricultural Cumulative Unmet Demand (2022 to 2121)
Agricultural/Municipal Cumulative Unmet Demand (2022 to 2121)
Industrial Cumulative Unmet Demand (2022 to 2121)
Municipal Cumulative Unmet Demand (2022 to 2121)
Analysis Cumulative Unmet Demand (2022 to 2121)
Certificate Cumulative Unmet Demand (2022 to 2121)
Designation Cumulative Unmet Demand (2022 to 2121)
LTSC Unmet Cumulative Demand (2022 to 2121)
Water Report Cumulative Unmet Demand (2022 to 2121)
Other Cumulative Unmet Demand (2022 to 2121)
2.7 MAF
1.3 MAF
0.7 MAF
2022
2026
2030
2034
2038
2042
2046
2050
2054
2058
2062
2066
2070
2074
2078
2082
2086
2090
2094
2098
2102
2106
2110
2114
2118
Year

Unmet Demand After 100 Years

- Total future demand ≈ 140 MAF over 100 years
- Unmet demand from:
  - Existing ag = 2.7 MAF
  - Analyses = 1.3 MAF
  - Certificates = 0.7 MAF
  - Designations = 0.1 MAF

All unmet demand = 4.9 MAF
(4% of total)

Cumulative Modeled Storage Change



Key Takeaways (1)

- AWS Program is working as intended
  - We have time to make water management decisions
  - This is an inflection point
- Projected future outflows exceed projected future inflows by a factor of 1.4
- At the end of 100 years, depth to water in areas near the edges of the groundwater basin is projected to exceed 1,000 ft or hit bedrock
- Unmet demand in existing and AWS wells is projected to be 4.9 MAF over the 100-year period (4% of total demand)

Key Takeaways (2)

- Existing homes built pursuant to the AWS program have secure water supplies
- Significant volumes of groundwater and other water supplies are available for continued growth
- Water providers in the Phoenix AMA have diverse water supplies and are not solely reliant on groundwater
- People are not running out of water